

# **Chemistry I**

## **Chapter 1/2: Matter**

# Introduction

- ◆ Chemistry is defined as the study of matter and its changes

# **Types of Chemistry:**

# **1. Geochemistry-study of earth materials and processes**

## **2. Biochemistry-** **study of substances and** **processes that occur in** **living things**

### **3. Organic Chemistry- study of carbon and carbon based compounds and their changes**

# **4. Inorganic Chemistry-** **study of all other** **elements and their** **changes**

# Matter

- Is anything that has mass and volume



# Matter

- Two definitions:
  - Mass is the amount of matter something has
  - Volume is the amount of space something occupies

# Law of Conservation of Matter

- Matter cannot be created nor destroyed in *ordinary* chemical reactions
- Falls apart in nuclear reactions

# Properties of Matter

- Properties are characteristics that allow us to tell one kind of matter from another

# **Two** types of Properties of Matter

- Physical Properties can be observed or measured
- Chemical properties are how a substance reacts with other stuff or conditions

# Physical Properties

Density, color, hardness, melting point, boiling point are physical properties.

# Changes in Matter

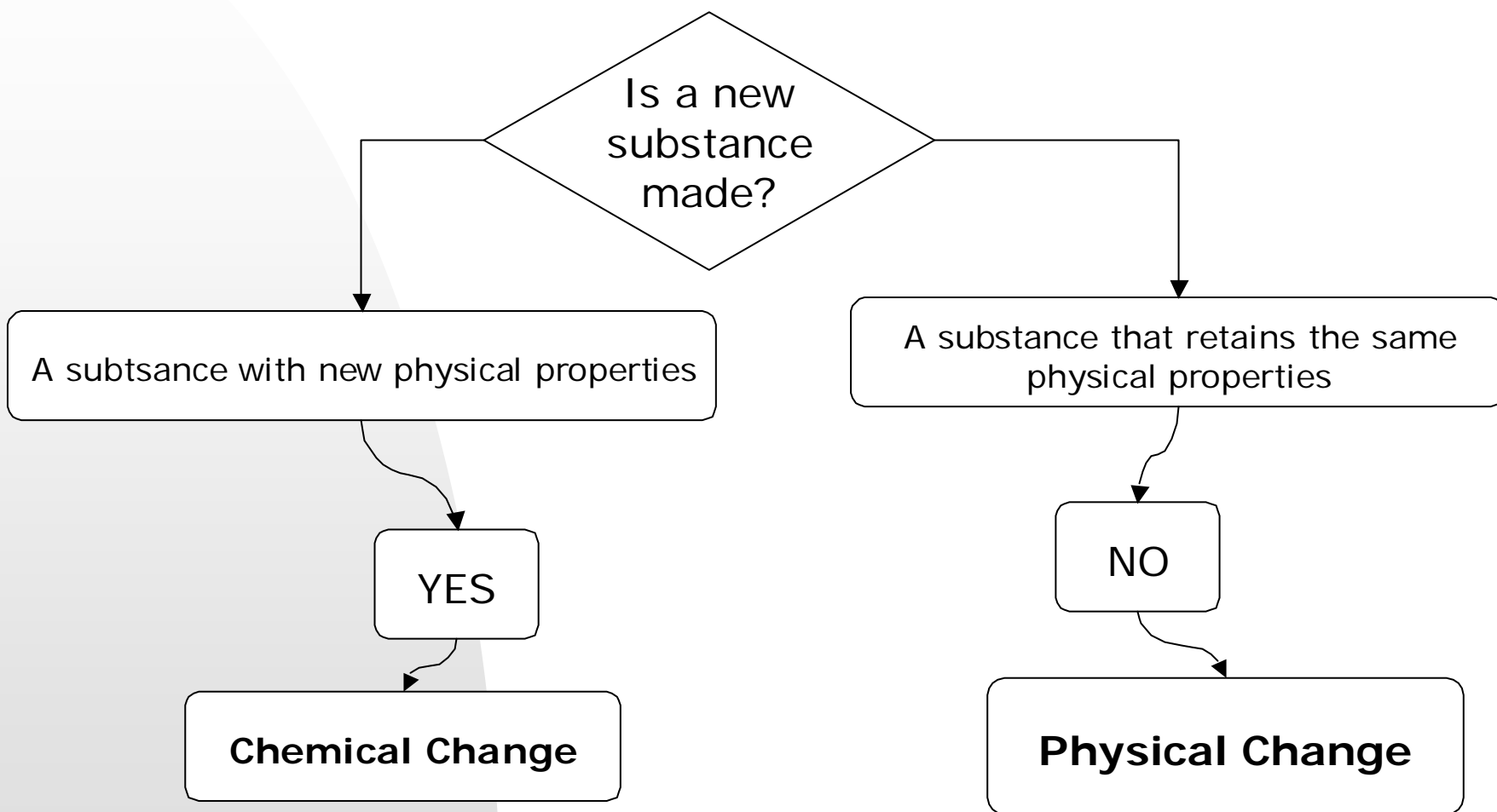
Two basic change types :

1. Changes that do not result in a new substance are called physical changes
2. Changes that result in a new substance are called chemical changes

# Changes in Matter

- Now how do you tell the difference?
  - You pose the question: Is a new substance made doing this change?
    - If YES then a chemical change has occurred;
    - if NO then a physical change has occurred.

# Classification of Changes





# Evidence of Chemical Changes

- 1.The production of a precipitate (a water insoluble compound that ends up at the bottom of the test tube)
- 2.The release of heat (exothermic)
- 3.The release of light
- 4.The release of a gas
- 5.Change in color
- 6.The production of electricity

# Things that promote Chemical Change

1. Addition of a catalyst (a substance that makes the chemical reaction work but does not change)
2. Exposure of the reactants to light (photography)
3. Heating the reactants
4. Passing electricity through the reactants
5. Putting the reactants into water solution
6. Stirring/agitating the reactants

# **Energy and States of Matter**

When energy is added to or taken away from a mass of matter, the matter may change state.

# **Energy and States of Matter**

We call these changes melting, freezing, boiling, etc.

# **Energy and States of Matter**

The energy that causes these changes is usually heat which is measured in calories or joules.

# **Heat in; Heat out**

Heat is usually released or absorbed doing a physical or chemical change.

Two terms are applied to that show which way the heat flows: endothermic and exothermic

Endothermic processes  
Require heat to be added  
Or absorbed  
EX: ice melting



Exothermic processes are those processes that will release heat energy.

Ex: Steam condensing and  
Most chemical reactions

Two things about heat:  
Heat always travels from  
Higher to lower (hot to  
cold)  
Heat is a form of energy  
and therefore can only be  
transformed

Heat cannot be directly measured. It can be indirectly measured by changes in temperature.

# Entropy

Entropy is a measure of disorder something has.

Higher entropy is more disorder (disorganization).

Lower entropy less disorder (more organized)

Explanation: Water  
The water molecules in ice are well organized into a crystal. They have low energy and low entropy.

The water molecules in steam have high energy and high entropy. These molecules are all over the place.

So. Let's make some general statements about energy and entropy.

1. Nature tends to move to higher entropy but to a lower amt of energy.

2. Add more energy and the degree of entropy will increase.

3. Take energy away and the degree of entropy decreases.

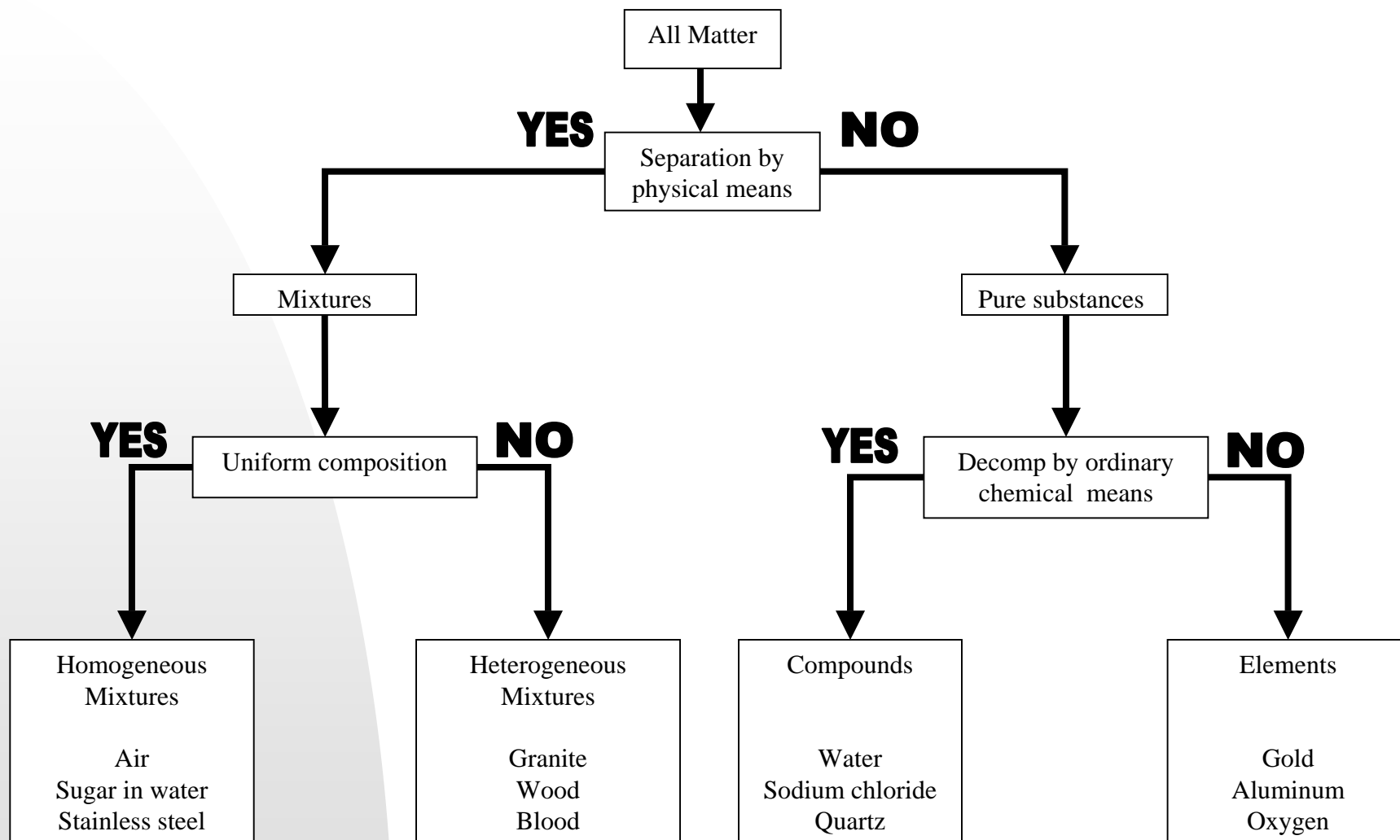


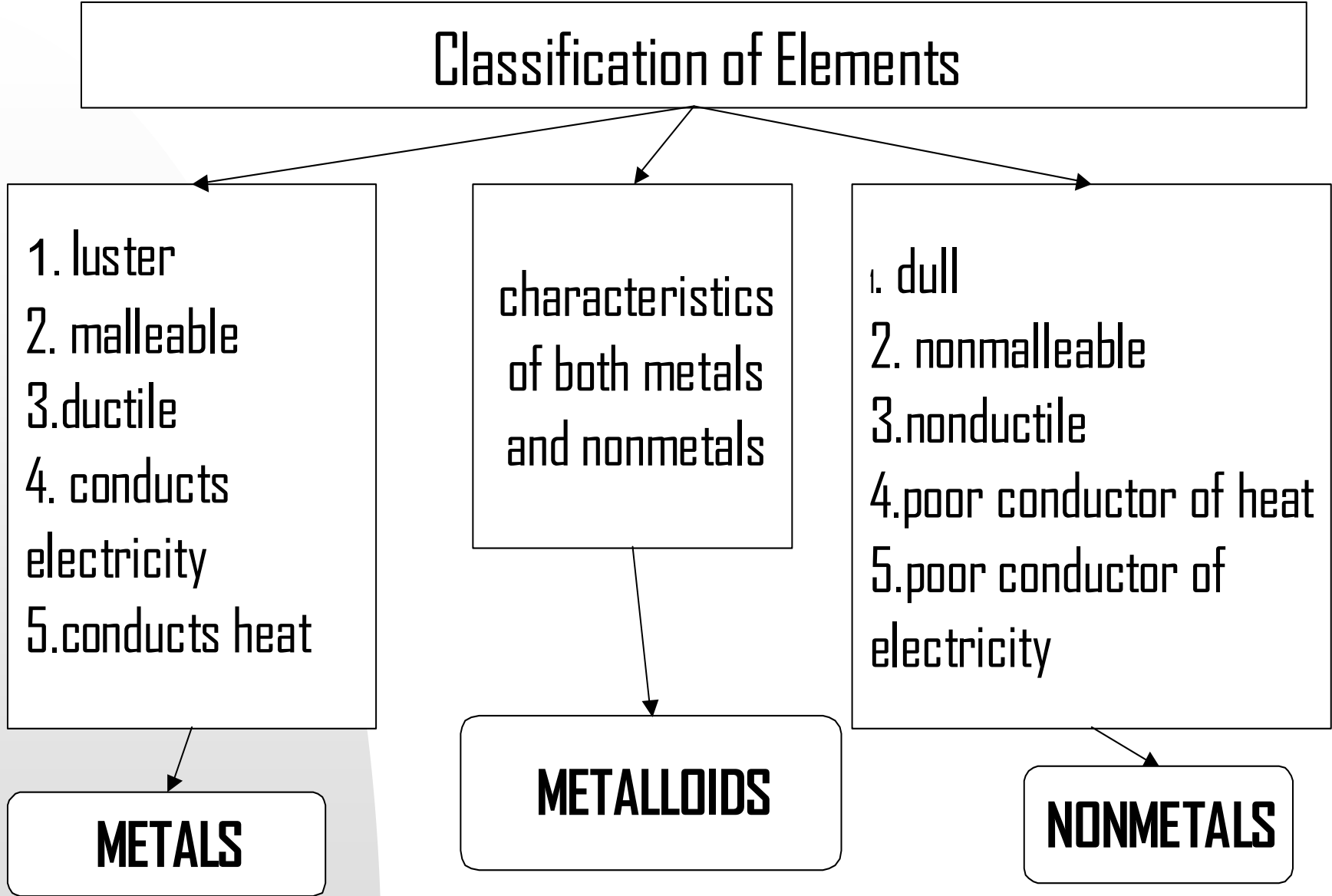
# Classification of Matter

## Terms

1. Matter- anything that has mass and volume
2. Mixture-
  - a. Any substance that can be taken apart by physical means
  - b. Two or more kinds of matter combined together where each kind of matter retains its physical properties.
3. Pure substance- any substance that can not be taken apart by physical means (same stuff throughout)
4. Physical means – a way to separate a mixture without changing the substances that make it up.

# THE CLASSIFICATION OF MATTER





# The Modern Periodic Table

- The known elements have been organized into a chart by their chemical and physical properties.
- In 1951, Glenn Seaborg was awarded the Nobel Prize in chemistry for his work on developing the Modern Periodic Table. Element 106 has been named seaborgium (Sg) in his honor.

# Parts of the Periodic Table

Rows on the Periodic Table are called periods or series.

- They are numbered 1 to 7.
- The columns on the Periodic Table are called families or groups.
- The elements are grouped according to the physical and chemical properties.
- The columns are numbered 1 to 18
- The old system used Roman numerals and letters to denote groups and subgroups

# Element Families on the Periodic Table

- The 112 elements can be divided, by their properties, into 9 separate families or groups.
- The elements are grouped together by similar chemical and physical properties.

# Metals

- Elements in Groups 1-12 and some under the stair step.
- These elements have the characteristics of metals

# Non-Metals

- Non-metals are the elements in groups 13 to 18.
- The non-metals are in two states of matter at room temperature gases (such as oxygen) and solids (such as carbon).



# Metalloids

- Metalloids are the elements found along the stair-step line that distinguishes metals from non-metals.
- This line is drawn from between Boron and Aluminum to the border between Polonium and Astatine.
- Only exception to this is Aluminum, which is considered to be an "other metal".
- Metalloids have properties of both metals and non-metals.
- Metalloids, such as silicon and germanium, are semi-conductors. This property makes metalloids useful in computers and calculators

# Noble Gases

- The six noble gases are found in Group 18.
- These elements are: helium, neon, argon, krypton, xenon, and radon.
- The noble gases have great difficulty forming compounds.
- Noble gases the most stable elements.